

BIRDS AS WEED DESTROYERS.

By SYLVESTER D. JUDD, Ph. D.

Assistant in Biological Survey.

INTRODUCTION.

The problem of weed destruction is perennial in every land where agriculture is practiced. Indeed, so serious is it, that soil culture may be said to be an everlasting war against weeds. For a thorough understanding of the weed problem, it is necessary not only to define a weed, and to study its relation to crops, but to ascertain what are the agents, natural or artificial, which act as weed destroyers.

A weed is a plant out of place. Certain plants seem to have formed a habit of constantly getting out of place, and installing themselves in cultivated ground. Whether actually among crops or in adjacent waste land, from which they can spread to cultivated soil, they are always a menace. In the garden they occupy the room allotted to useful plants and appropriate their light, water, and food, so that any check on these noxious plants, a million of which can spring up on a single acre, will not only lessen nature's chance of populating the soil with these worse than useless species, but will enable the farmer to attain greater success with cultivated crops. The hoe and the cultivator will do much to eradicate them, but some will always succeed in ripening a multitude of seeds to sprout the following season. Certain garden weeds produce an incredible number of seeds. A single plant of one of these species may mature as many as a hundred thousand seeds in a season, and if unchecked would produce in the spring of the third year ten billion plants.

SEED-EATING BIRDS.

Fortunately certain agents are at work to check this harvest, and perhaps the most efficient among them are seed-eating birds. Each fall and winter they flock in myriads to agricultural districts and live upon the ripened seed of weeds. Since they attack weeds in the most critical stage of life, the seed period, it follows that their services must be of enormous practical value. The benefits are greatest in the case of hoed crops, since here are found the largest number of annual weeds, which, of course, are killed by frost and must depend for perpetuation solely upon seeds. The principal weeds which birds

prevent from seeding are ragweed, pigeon grass, smartweed, bindweed, crab grass, lamb's-quarters, and pigweed. (See fig. 59.) It is sometimes asserted that no thrifty farmer will allow these noxious species to ripen seed, but such prevention is practically impossible, because even if all the edges of fields and all waste ground could be cleared, weed patches along ditches, roads, and hedgerows would still remain

to disseminate seed to cultivated land. It is in just these places that birds congregate in greatest numbers.

Some birds eat more or less weed seed throughout the year even when insects are most abundant. But their good work practically extends from early autumn until late spring, and is perhaps most noticeable in winter, when the ground is white with snow. During cold weather most of the birds about the farm feed extensively upon seed, and gorge themselves until their stomachs and gullets become completely distended. It is not at all uncommon for a crow blackbird to eat from 30 to 50 seeds of smartweed or bindweed, or a field sparrow 100 seeds of crab grass, at a single meal. In the stomach of a Nuttall's sparrow were found 300 seeds of amaranth (see fig. 60), and in another 300 seeds of lamb's-quarters; a tree sparrow had consumed 700 seeds of pigeon grass, while a snowflake from Shrewsbury, Mass., which had been break-



FIG. 59.—Four common weeds, the seeds of which are eaten by birds: *a*, amaranth; *b*, crab grass; *c*, ragweed; *d*, pigeon grass.

fasting in a garden in February, had picked up 1,000 seeds of pigweed. The birds most actively engaged in consuming weed seed are sparrows and finches, including more than a score of species,¹ horned larks, blackbirds, cowbirds, meadow larks, doves, and quail.

¹These species include the tree, song, field, chipping, grasshopper, fox, Nuttall's, golden-crowned, white-crowned, and white-throated sparrows, juncos, snowflakes, goldfinches, pine siskin, redpolls, towhees, and grosbeaks.

SPARROWS AND FINCHES.

Sparrows are the most abundant and widely distributed of the smaller birds inhabiting the rural districts of the United States. Their intimate association with agricultural interests has suggested the importance of a careful inquiry as to their food habits, and such an investigation based on field observations and an examination of the contents of stomachs in the laboratory is now being made by the Biological Survey. Sparrows have been collected in practically all the States, the District of Columbia, and Canada, and some 4,000 stomachs have already been examined. The results show that during the colder half of the year the food of these birds consists almost entirely of the seeds of weeds.

Sparrows generally seem to be regarded with favor, but the English sparrow drives away native birds and does so much damage to grain and fruit that it is considered a pest. The native sparrows might also be suspected of injuring crops; but though they frequently sample grain in stubble fields they have not, as yet, been found guilty of committing serious depredations. In order to compare the grain-eating propensities of the various species, specimens were collected in a field a few miles south of Washington, D. C., before and after the wheat was cut. Of nineteen native birds, representing song, field, chipping, and grasshopper sparrows, only two had eaten grain, and these had taken only one kernel each, while every one of the five English sparrows was gorged with wheat. But with all his faults, the English sparrow does some good by assisting in the work of weed-seed destruction. Flocks of thousands of these birds may be seen every autumn on the lawns of the Department of Agriculture, feeding on crab grass (*Panicum sanguinale*) and yard grass (*Eleusine indica*), two weeds which crowd out good turf-making grasses. The English sparrow also deserves credit for destroying seed of the dandelion (*Taraxacum taraxacum*), which is a prolific weed throughout the United States, especially in lawns, cemeteries, and pastures.

In 1894 English sparrows were observed by the writer destroying dandelion seeds in Cambridge, Mass., and during the last three years in the public parks of Washington, D. C. In the latter city

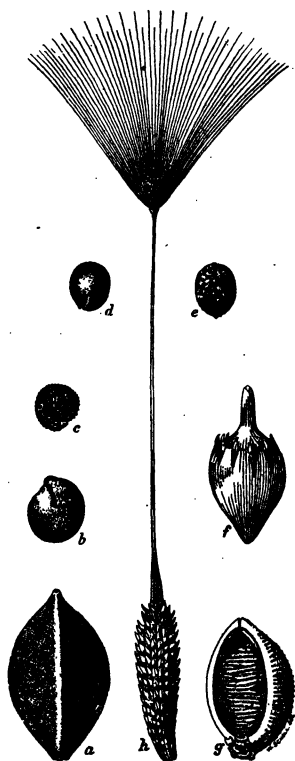


FIG. 60.—Weed seeds commonly eaten by birds: a, bindweed; b, lamb's-quarters; c, purslane; d, amaranth; e, spotted spurge; f, ragweed; g, pigeon grass; h, dandelion.

the birds eat these seeds from the middle of March until the middle of August, but chiefly in April and the first half of May, when the lawns are literally yellow with flowers. After the yellow petal-like corollas have disappeared the flower presents an elongated, green, egg-shaped body with a downy tuft at the upper end, and in this stage it is most frequently attacked by the English sparrow. The bird removes several long scales of the inner involucre by a clean cut close to the receptacle or base of the head, thus exposing the plumed seeds, or akenes. He seizes a mouthful of these akenes and then lops off the plumes with his bill and swallows the seeds. In many cases, especially when hungry, he does not take the trouble to remove the plumes. Generally a score of seeds are dropped in tearing open a



FIG. 61.—Song sparrow (*Melospiza fasciata*).

head, and usually a few are left clinging to the edge of the receptacle. The mutilation caused by the birds' beaks can be detected until the flower stalk dries and falls.

In order to determine how much damage was done to dandelions on the lawns of the Department of Agriculture, every flower stalk was picked

from a rectangular space 6 feet 2 inches long by 3 feet 3 inches wide. This was on April 29, 1898. Of the 413 stalks collected, 358 showed unmistakable marks of the sparrow's bill. On the next day 293 stalks were gathered from a circle 2 feet in diameter on the other side of the lawn, and 275, or 93 per cent, proved to be mutilated. These and similar observations seem to show that at least three-fourths of the dandelions which bloom in April and May on the Department lawns are mutilated by birds.

In the destruction of dandelion seeds the English sparrow is aided by several native birds, chiefly the song sparrow (*Melospiza fasciata*), chipping sparrow (*Spizella socialis*), white-throated sparrow (*Zonotrichia albicollis*), and goldfinch (*Astragalinus tristis*). So far as observed the native birds usually do not cut open dandelions, but feed upon those left by the English sparrow. The song sparrow, however, is capable of getting out seeds alone, for one which was kept in captivity manipulated dandelions in precisely the same way as the English sparrow. The song sparrow (fig. 61) and the chipping sparrow make a practice of feeding from the short-stemmed heads that have already



FOUR COMMON SEED-EATING BIRDS.

1, Junco; 2, White-throated Sparrow; 3, Fox Sparrow; 4, Tree Sparrow.

been opened, but even here the chipping sparrow has difficulty in pulling out the seeds, and often simply picks up those which have been dropped. Goldfinches frequently pursue an entirely different course, although they also pick seeds from the green involucres torn open by English sparrows. On May 3, 1898, a dozen goldfinches were observed for a couple of hours on the Department lawns. First they hopped along the ground; then one bird flew to a dandelion stalk 6 inches high,

alighted crosswise, and moving toward the downy ball until it bent the whole stem to the ground, ate seed after seed (fig. 62).

Besides the lawn weeds already mentioned, such as dandelions, crab grass, and yard grass, several others, including pigeon grass, knotweed, sedge, oxalis, and chickweed furnish food for birds. These plants are also troublesome in other places besides lawns. Knotweed (*Polygonum aviculare*) litters up paths and roads or grows in spots where turf is broken, chickweed (*Alsine media*) occurs in plowed ground, and

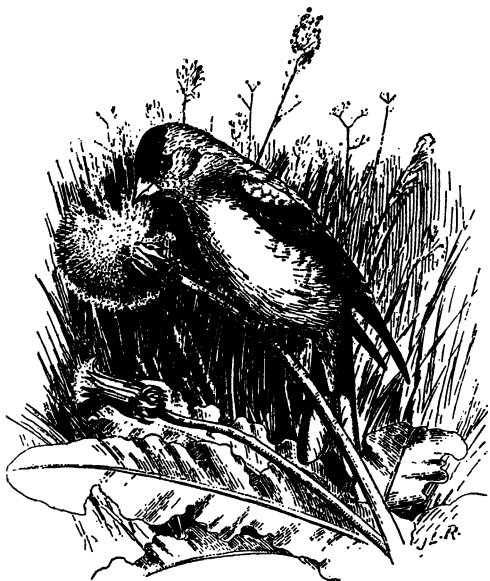


FIG. 62.—Goldfinch (*Astragalinus tristis*).

pigeon grass (*Chaetocloa glauca* and *C. viridis*), which is considered one of the worst weeds in Minnesota, is found among many crops. The seeds of these plants are eaten by the song sparrow, chipping sparrow, field sparrow, junco, English sparrow, tree sparrow, Gambel's sparrow, and white-throated and white-crowned sparrows.

Among the weeds which are troublesome in fields, especially among hoed crops, may be mentioned ragweed (*Ambrosia artemisiæfolia*), several species of the genus *Polygonum*, including bindweed (*P. convolvulus*), smartweed (*P. lapathifolium*), and knotweed (*P. aviculare*), pigweed (*Amarantus retroflexus* and other species), nut grass and other sedges (*Cyperaceæ*), crab grass (*Panicum sanguinale*), pigeon grass (*Chaetocloa viridis* and *glauca*), lamb's-quarters (*Chenopodium album*), and chickweed (*Alsine media*). Every one of these weeds is an annual, not living over the winter, and their seeds constitute fully three-fourths of the food of a score of native sparrows during the colder half of the year. Prof. F. E. L. Beal, who has carefully studied this subject in the Upper Mississippi Valley, has estimated the amount of weed seed eaten by the tree sparrow (*Spizella*

monticola), junco (*Junco hyemalis*), and other sparrows that swarm down from Canada in the fall and feed in the rank growth of weeds bordering roadsides and cultivated fields. He examined the stomachs of many tree sparrows and found them entirely filled with weed seed, and concluded that each bird consumed at least a quarter of an ounce daily. Upon this basis, after making a fair allowance of the number of birds to the square mile, he calculated that in the State of Iowa alone the tree sparrow annually destroys about 1,750,000 pounds, or about 875 tons, of weed seed during its winter sojourn.

Besides tree sparrows and juncos, the most important gregarious sparrows that destroy weeds in the Mississippi Valley and on the Great Plains are the fox sparrow (*Passerella iliaca*), snowflake (*Passerina nivalis*), the white-crowned sparrow (*Zonotrichia leucophrys*), Harris's sparrow (*Zonotrichia querula*), and longspurs (*Calcarius lapponicus*, *C. ornatus*, *C. pictus*, and *Rhyncophanes mccownii*). Farther south are found lark finches (*Chondestes grammacus* and *Chondestes grammacus strigatus*), while on the Pacific slope occur Nuttall's sparrow (*Zonotrichia l. nuttalli*), the golden-crowned sparrow (*Zonotrichia coronata*), and Townsend's sparrow (*Passerella iliaca unalaschcensis*). East of the Alleghenies the most active weed eaters are the tree sparrow, fox sparrow, junco, white-throated sparrow, song sparrow, field sparrow, and chipping sparrow. (See Pl. XV.)

On a farm in Maryland, just outside the District of Columbia, tree sparrows, fox sparrows, whitethroats, song sparrows, and juncos fairly swarmed during December in the briars of the ditches between the cornfields. They came into the open fields to feed upon weed seed, and worked hardest where the smartweed formed a tangle on low ground. Later in the season the place was carefully examined. In one cornfield near a ditch the smartweed formed a thicket over 3 feet high, and the ground beneath was literally black with seeds. Examination showed that these seeds had been cracked open and the meat removed. In a rectangular space of 18 square inches were found 1,130 half seeds and only 2 whole seeds. Even as late as May 13 the birds were still feeding on the seeds of these and other weeds in the fields; in fact, out of a collection of 16 sparrows, 12, mainly song, chipping, and field sparrows, had been eating old weed seed. A search was made for seeds of various weeds; but so thoroughly had the work been done that only half a dozen seeds could be found. The birds had taken practically all the seed that was not covered; in fact, the song sparrow and several others scratch up much buried seed.

Most of the song sparrows, practically all the field, chipping, vesper, and grasshopper sparrows, dickcissels, lark finches, and Harris's sparrows of the central portion of the United States spend the winter in the South, while their places are taken in the North by snowflakes, juncos, clay-colored longspurs, fox sparrows, and white-throated and white-crowned sparrows. All these birds have much the same food

habits, but they differ in the quantity and kind of seed which they eat. Thus, the tree sparrows, or "winter chippies," snowflakes, and longspurs feed largely upon seeds of grasses, especially those of pigeon grass, crab grass, and allied species, while the white-throated sparrow in the Eastern States, Nuttall's sparrow in the Pacific-coast region, and the white-crowned sparrow so abundant in the central part of the United States, are particularly fond of amaranth and lamb's-quarters. In January the whitethroat depends upon ragweed and various species of *Polygonum*, such as bindweed, knotweed, and smartweed, for more than half of its food; the white-crowned and fox sparrows take nearly as much as the whitethroat, while juncos destroy a still greater amount of ragweed.



FIG. 63.—Dickcissel (*Spiza americana*).

The chippy and song sparrow are perhaps the best known of all the native sparrows of the United States. When not living in hedgerows or bushes about buildings the song sparrow inhabits the shrubbery along water courses. It seeks its food on the ground, generally among bushes or weeds, and has a peculiar mouse-like way of running through the grass. Seeds of weeds, especially smartweed, bindweed, and other species of the genus *Polygonum*, pigeon grass, pigweed, lamb's-quarters, and ragweed, and also some crab grass, form four-fifths of the food of this species during the colder half of the year. Ninety-five out of a hundred of the birds collected during March and

April had eaten weed seed, and many stomachs contained from 50 to 200 seeds each.

The chipping sparrow is a familiar little bird, readily recognized by its reddish cap, cicada-like note, and habit of lining its nest with horsehair. It eats the seeds of such troublesome grasses as pigeon grass, crab grass, and closely allied species, and during September and October these and other weed seeds make up three-fourths of its food.

The field sparrow (*Spizella pusilla*) is closely related to the chipping sparrow, but may be distinguished by its reddish bill. It is thoroughly commonplace in appearance, and in habits is much shyer than the chipping sparrow, which is often called a dooryard bird. Field sparrows are very abundant about the farm, and their food consists of practically the same seeds as those eaten by its relative.

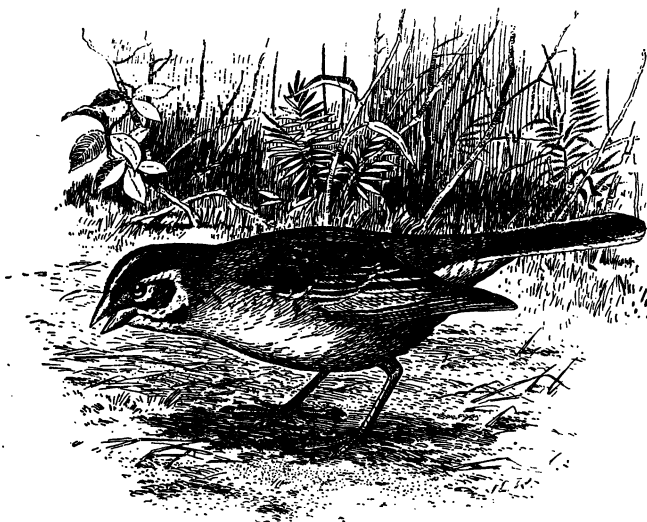


FIG. 64.—Lark finch (*Chondestes grammacus*).

The grasshopper sparrow (*Ammodramus savannarum passerinus*), so called from its dry, monotonous note, is even more a bird of the fields than the field sparrow. It is one of the few species that eats the seeds of rib grass (*Plantago lanceolata*). The dickcissel (*Spiza americana*, fig. 63) of the Central States, which also has an insect-like note, is larger than the grasshopper sparrow, and its plumage is conspicuously marked with bright yellow, black, and gray, somewhat like that of a meadow lark. The lark finch (*Chondestes grammacus*, fig. 64) is also a large sparrow of striking appearance. Its head is striped with black, and from this fact it is known in certain sections as "snake bird." It is particularly fond of the seeds of leguminous plants. The vesper sparrow (*Poæcetes gramineus*), celebrated for its twilight chanting, is as much a bird of the open grassy fields

as the lark finch or dickcissel. When disturbed it flits up from the ground, spreading its white-splashed tail, and alights but a short distance away to resume its work. However varied in dress or habit, all the native sparrows are alike in subsisting largely upon seeds of noxious plants.

The goldfinch (*Astragalinus tristis*, fig. 62), or wild canary, is as useful as it is beautiful, and as a weed destroyer has few equals. It confines its attention very largely to one family of plants, the Compositæ, and is especially fond of thistles, wild lettuce, wild sunflower, and ragweed. It is so often seen on thistles, both Canada and bull thistles, that it is commonly known as the thistle bird. Near Washington, D. C., a flock of a dozen birds was seen during the latter part of August feeding on sunflowers that had escaped from cultivation, and in the Central and Western States the goldfinches do much good by eating the seeds of wild sunflowers and other closely related weeds. They have also been seen feeding upon wild lettuce (*Lactuca spicata*), and probably eat prickly lettuce (*Lactuca scariola*), which has proved the most rapidly spreading weed ever introduced into this country, but as yet no actual observations as to the latter food habit have been made. Stomachs collected in August were filled with seeds of Compositæ, mostly sunflowers (various species of *Helianthus*) and thistles (*Carduus lanceolatus* and other species).

At Burlington, Iowa, during July and August, Mr. Paul Bartsch found goldfinches feeding exclusively upon the bull thistle (*Carduus lanceolatus*). He was able to approach within a few feet of several birds while thus engaged, and noticed that the seeds or akenes were bitten off and swallowed, while the plumes or pappus floated away. When there was no wind, the pappus often failed to fly away, and clung to the birds, almost burying them with down. A dozen of the birds were killed and their gizzards and gullets were found literally crammed with thistle seeds. At Sing Sing, N. Y., goldfinches have been seen eating the seeds of the Scotch thistle (*Onopordon acanthium*) and boneset (*Eupatorium perfoliatum*). Cone flowers (*Rudbeckia hirta*), prairie sunflowers (*Gaillardia*), evening primroses, catnip, elephant's foot (*Elephantopus* sp.), and mullein also form part of their food, and late in the season they turn their attention to ragweed and consume great quantities of the seeds of this troublesome species. In winter and spring large flocks feed to some extent upon the seeds of conifers and catkin-bearing trees, such as the sycamore and birch. In destroying the seeds of the gray birch (*Betula populifolia*) on the edge of grass lands they do some good, for this tree has a habit of seeding adjacent pastures, which then grow up into a thicket of young saplings.

The pine siskin (*Spinus pinus*) and the redpoll linnet (*Acanthis linaria*) are two drab-gray birds related to the goldfinch, which feed largely upon seeds of conifers, sycamores, birches, and alders, but also descend to the ground to eat weed seed. In winter they feed upon sow thistles (*Sonchus oleraceus*), field asters (*Aster* sp.), and golden-rods (*Solidago* sp.). The redpoll linnet is known to destroy mullein

seeds (*Verbascum thapsus*), and the pine siskin is often seen consuming quantities of seeds of chickweed (*Alsine media*), lamb's-quarters (*Chenopodium album*), and ragweed (*Ambrosia artemisiæfolia*).

The common Eastern towhee, or chewink (*Pipilo erythrophthalmus*), and the green and the brown towhees of the far West are great scratchers, and there is little doubt but that they find many seeds that other birds fail to secure. Unfortunately, their food habits have not been sufficiently studied to furnish any detailed account of their value as weed destroyers.

The grosbeaks likewise have been insufficiently studied. The evening grosbeak (*Coccothraustes vespertinus*) and the rose-breasted grosbeak (*Zamelodia ludoviciana*) are known to eat seeds of ragweed, and the blue grosbeak (*Guiraca cærulea*) feeds upon a variety of weed seeds. The cardinal grosbeak (*Cardinalis cardinalis*), or redbird of the South, is abundant along hedgerows and briery tangles adjoining farms, and during the winter months does good work by feeding upon the seeds of such noxious plants as ragweed, pigeon grass, bindweed, and smartweed.

HORNED LARKS.

Horned larks (*Otocoris* sp.) occur either as residents or winter visitants throughout the greater part of the United States. They are strictly terrestrial, and inhabit either open fields, or grassy, gravelly, or sandy plains. In midwinter they may be found in flocks on plowed fields, where the land is lying fallow, picking up seeds of weeds, which if left would germinate and cause trouble the following season. When thus employed, the larks select mainly the same seeds as the cardinal grosbeak, but occasionally they also eat buttonweed (*Diodia teres*) and sorrel (*Rumex acetosella*).

BLACKBIRDS AND THEIR ALLIES.

The several species of blackbirds, although subsisting quite extensively upon weed seed, do considerable damage to crops. This is particularly noticeable in the Mississippi Valley, where redwings (*Agelaius phæniceus*), yellow-heads (*Xanthocephalus xanthocephalus*), and crow blackbirds (*Quiscalus quiscula*) flock to the grainfields by the million. The ravages in the rice fields of the South by the bobolink, or redbird (*Dolichonyx oryzivorus*), in company with the redwings, are even more serious. The rusty grackles (*Scolecophagus carolinus*), Brewer's blackbird (*Scolecophagus cyanocephalus*), and the cowbird (*Molothrus ater*) are less injurious. All these birds are fond of pigeon grass, paspalum, crab grass, pigweed, knotweed, and ragweed, and the cowbird also eats the seeds of wild sunflowers, gromwell (*Lithospermum* sp.), sorrel, mustard (*Brassica nigra*), chickweed, and thistle. More than 10 per cent of the food of the crow blackbird, and more than 75 per cent of that of the redwing, during the colder half of the year, consists of weed seed.

The meadow lark (*Sturnella magna*) has long been placed on the border line of game birds, but it is a mistake to class any bird as game when its usefulness and beauty so far surpass its value as food.

The farmer can not afford to dispense with the services of the meadow lark, for it busies itself all summer eating grasshoppers and noxious insects, and when autumn comes varies its diet with ragweed, pigeon grass, and other weeds, until in December these noxious plants comprise 25 per cent of its food.

GAME BIRDS.

The ruffed grouse (*Bonasa umbellus*) of the Eastern woodlands sometimes eats small quantities of weed seed, while the prairie hen (*Tympanuchus americanus*), seeking its food in the open or near cultivated fields in the great agricultural region of the Central United States, does still more service. In the West and Southwest the California valley quails (*Lophortyx californicus* and *L. californicus valli-*

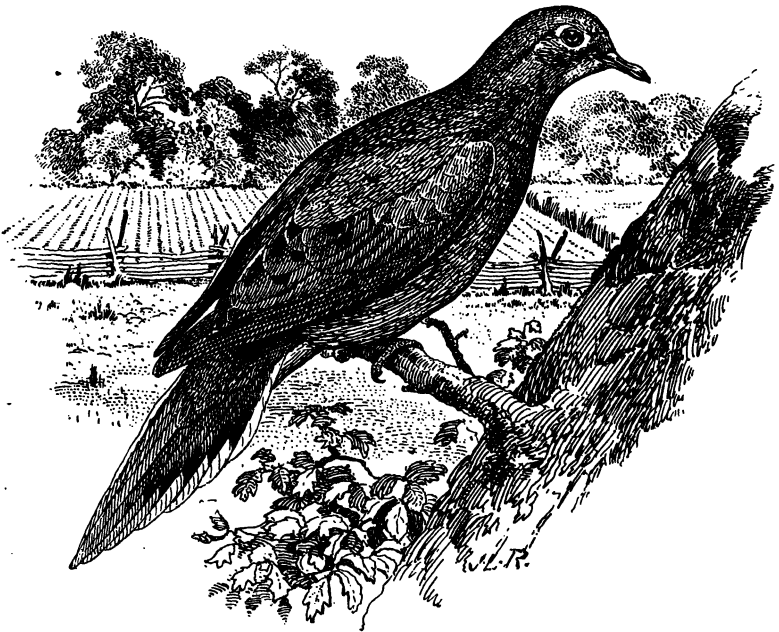


FIG. 65.—Mourning dove (*Zenaidura macroura*).

cola) and Gambel's quail (*Lophortyx gambelii*) consume weed seeds, but they also commit wholesale depredations on fruit. The Eastern quail, or bobwhite (*Colinus virginianus*), on the contrary, seldom if ever causes the fruit grower any trouble, but does much good by destroying weed seed in fields where grain has been cut and a rank growth of weeds has taken its place. Seeds of rib grass, tickfoil, and berries of nightshade (*Solanum* sp.) are sometimes eaten, and pigeon grass and smartweed are frequently consumed in large quantities. The amount of grain found in the few stomachs thus far examined is surprisingly small, while the proportion of weed seed is astonishingly large, in some cases crops and gizzards being literally gorged with hundreds of seeds of ragweed.

The mourning dove (*Zenaidura macroura*, fig. 65) is abundant

throughout much of the United States, and is especially common in stubble fields and waste places grown up to weeds. It is preeminently a seed eater, and although at times turning its attention to grain it nevertheless consumes an enormous amount of weed seed. The crop of one dove secured in a rye field in Warner, Tenn., contained 7,500 seeds of *Oxalis stricta*. Just outside the District of Columbia the bird has been seen feeding in fields overgrown with pigeon grass and ragweed, and especially in old cornfields, where smartweed and bindweed formed tangles of sufficient extent to injure the crop. In the Eastern States it has a peculiar habit of picking up pokeweed seeds and crushing them in its muscular stomach. Several weeds belonging to the genera *Lithospermum*, *Oxalis*, and *Euphorbia* are also utilized as food to a somewhat lesser extent. In California the dove feeds upon the seeds of a leguminous weed, known as turkey mullein (*Eremocarpus setigerus*). The habit is so well known in some localities that a botanist upon inquiring how he could collect some seeds of this plant was advised to shoot a few doves and open their crops. The ground dove (*Columbigallina passerina terrestris*) of the Southern States is very similar to the mourning dove in food habits, and probably does almost as much good in eradicating weeds.

SUMMARY.

No less than fifty different birds act as weed destroyers, and the noxious plants which they help to eradicate number more than threescore species. Some of these plants are much more in favor than others, while several are almost universally sought after. During the colder half of the year food is furnished for many species of birds by well-known and widely distributed weeds.

The blackbirds, the bobolink, the dove, and the English sparrow, in spite of grain-eating proclivities, do much good by consuming large quantities of weed seed.

Shore larks and grosbeaks also render considerable service, while the meadow lark is even more beneficial. Goldfinches destroy weeds which are not touched by other birds, confining their attacks chiefly to one group of plants (the Compositæ), many of the members of which are serious pests.

But the birds which accomplish most as weed destroyers are the score or more of native sparrows that flock to the weed patches in early autumn and remain until late spring. During cold weather they require an abundance of food to keep their bodies warm, and it is their habit to keep their stomachs and gullets heaping full. Often one of these birds is found to have eaten 300 seeds of pigeon grass or 500 seeds of lamb's-quarters or pigweed. Because of their gregarious and terrestrial habits, they are efficient consumers of seeds of ragweed, pigeon grass, crab grass, bindweed, purslane, smartweed, and pigweed. In short, these birds are little weeders whose work is seldom noted, but always felt.